Explicit Multicast Routing

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Plan

- Introduction of Group Communications
- Various types of Group Communications
- Multicast
- Problems of Multicast
- Multicast Forwarding Algorithms
- Multicast Routing
- Explicit Multicast Routing
- Extensions and Generalization of Multicast

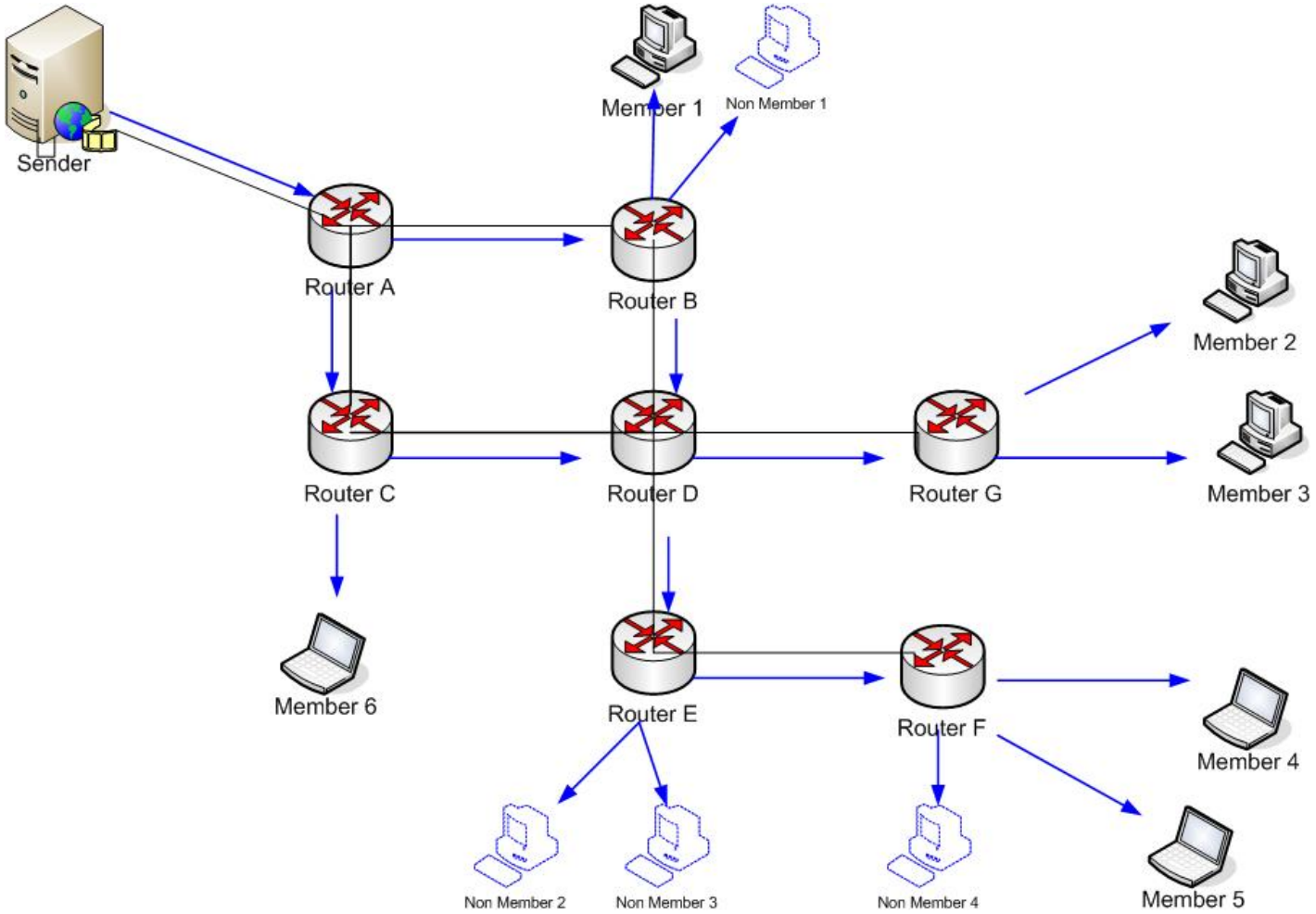
Group Communication

- Rapid growth of Communications
- Most them are Group Communications
- Goals
  - QoS
  - Reliability
  - Scalability

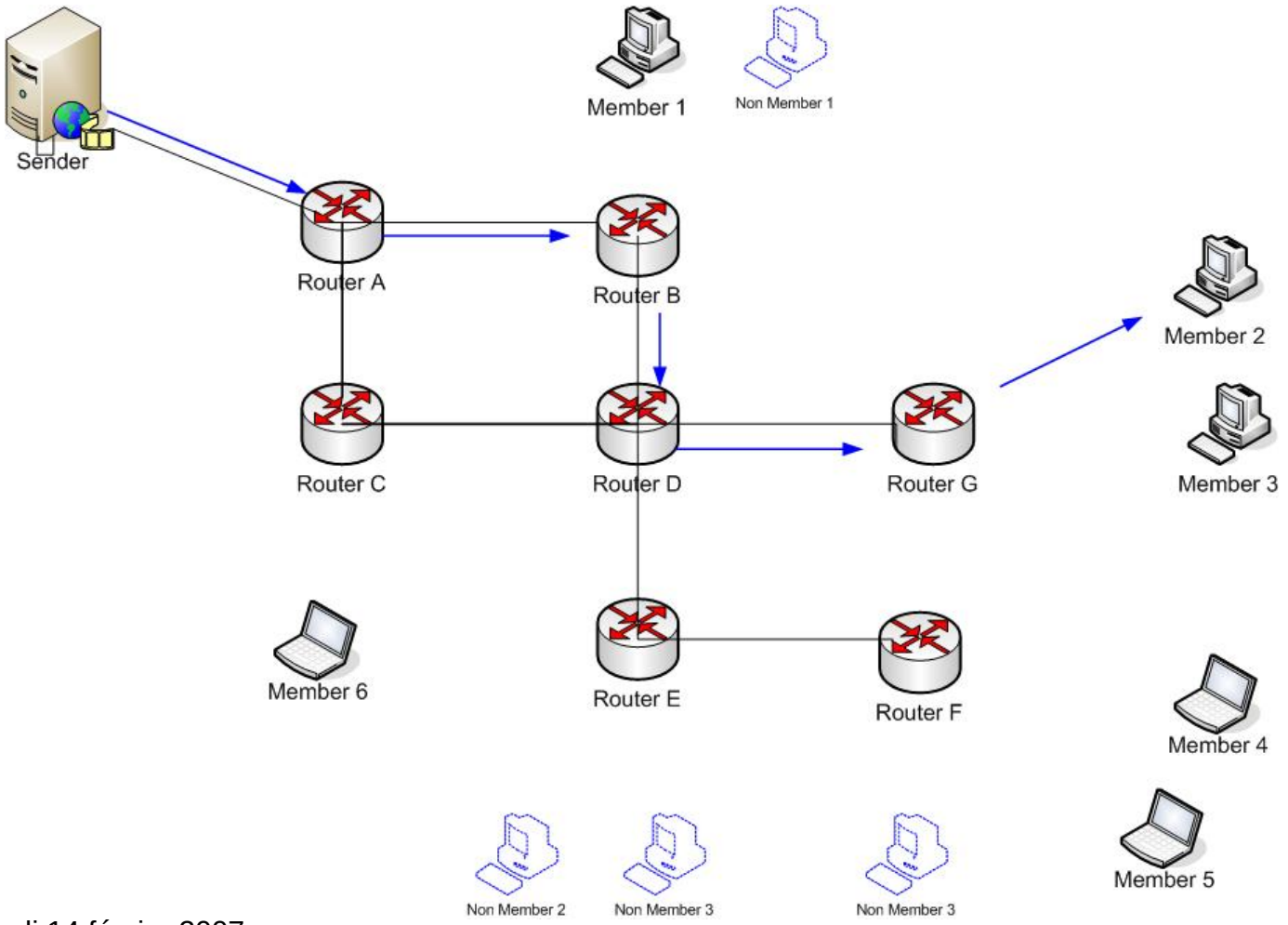
Types of Group Communication

- Broadcast Communication
- Anycast Communication
- Multi-Unicast Communication
- Multicast Communication

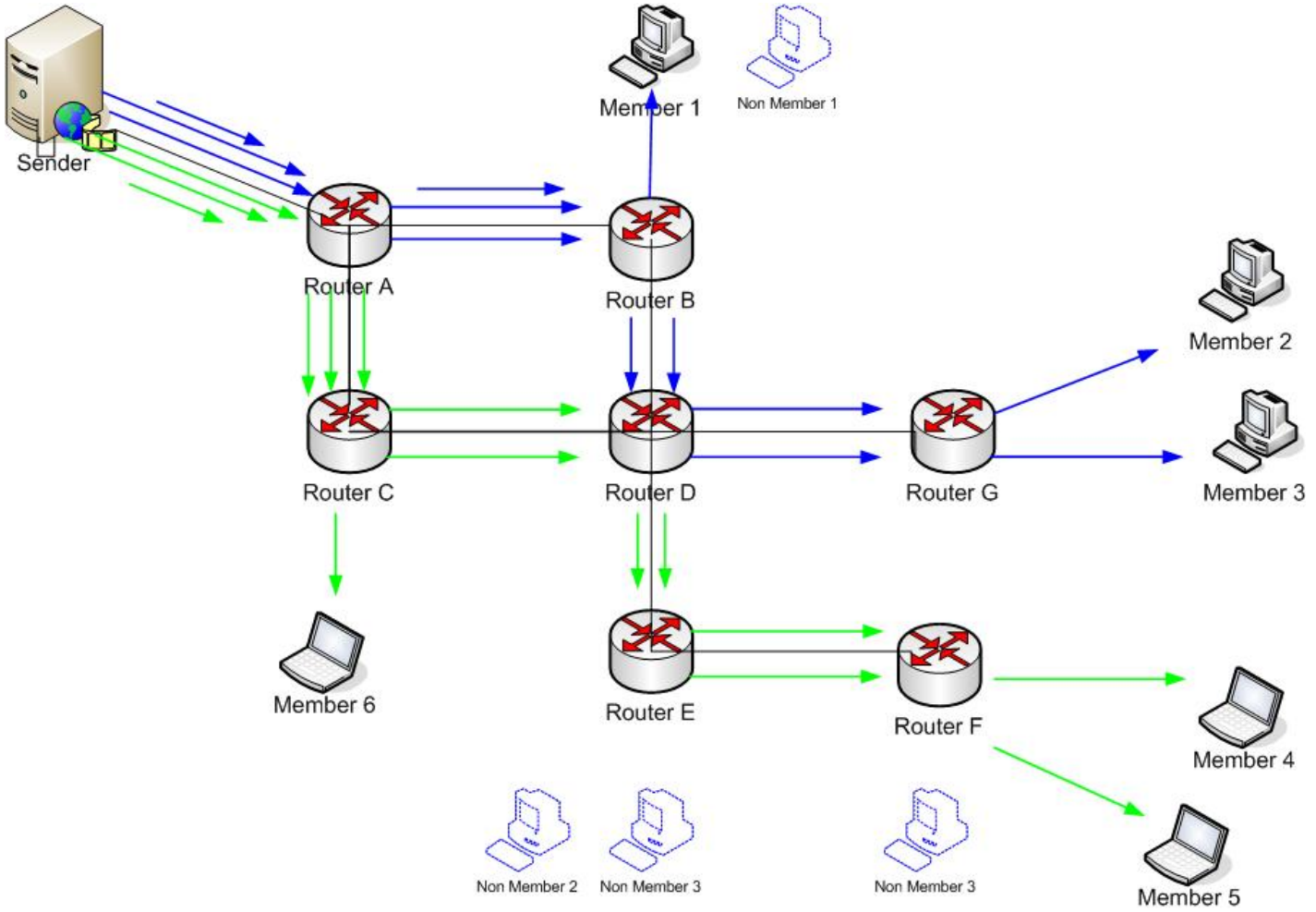
Broadcast Communication



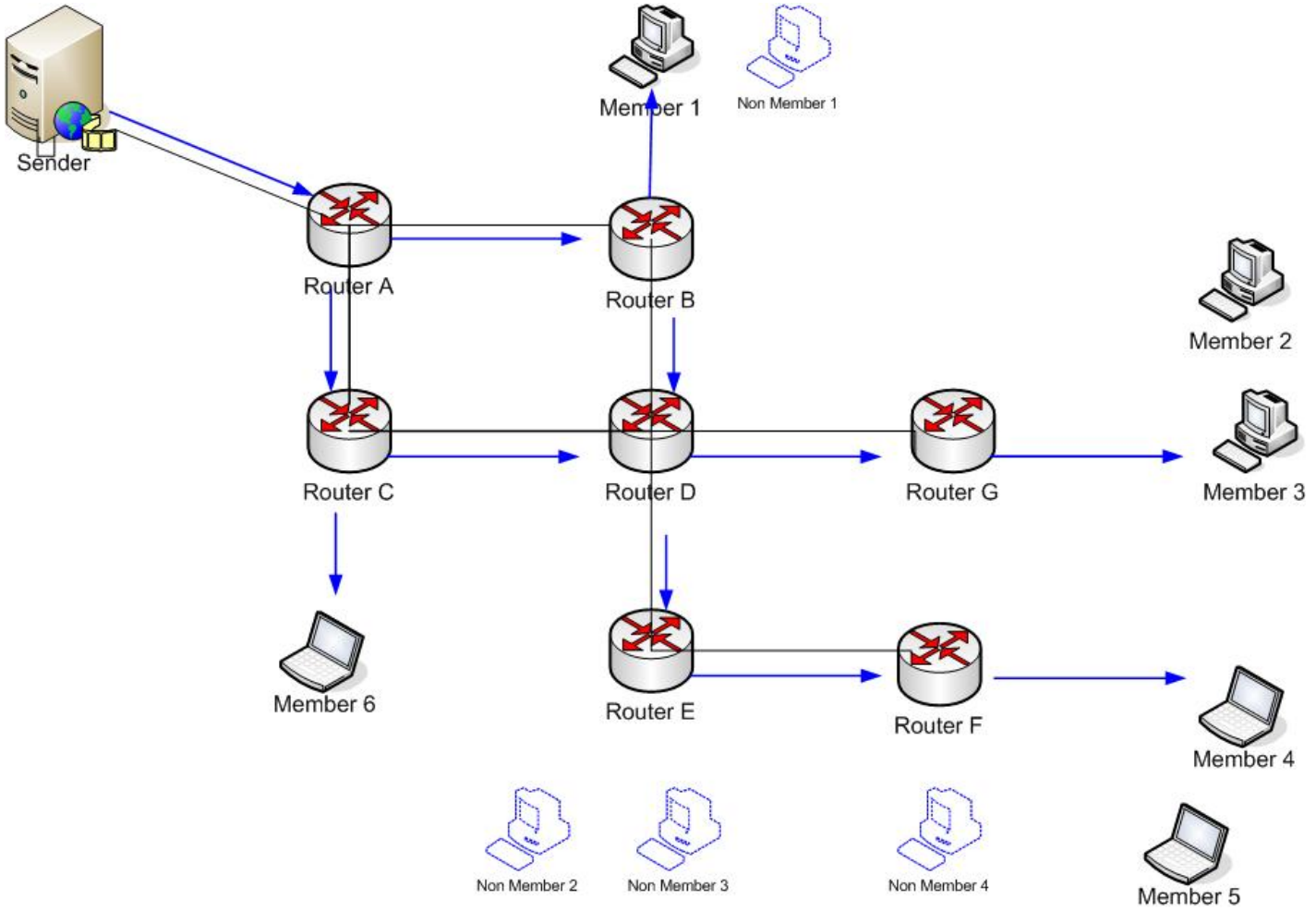
Anycast Communication



Multi-unicast Communication



Multicast Communication



Problems of Multicast

- Scalability, “Ability of system to perform well in presence of large number of nodes”
  - Group size
  - Group awareness
  - Group topology
  - Data Forwarding
- Reliability
  - Unreliable
  - Semi reliable
  - Reliable

Multicast Algorithms

- Flooding
- Spanning Tree
- Reverse Path Broadcasting
- Truncated Reverse Path Broadcasting
- Reverse Path Multicasting
- Core based Trees

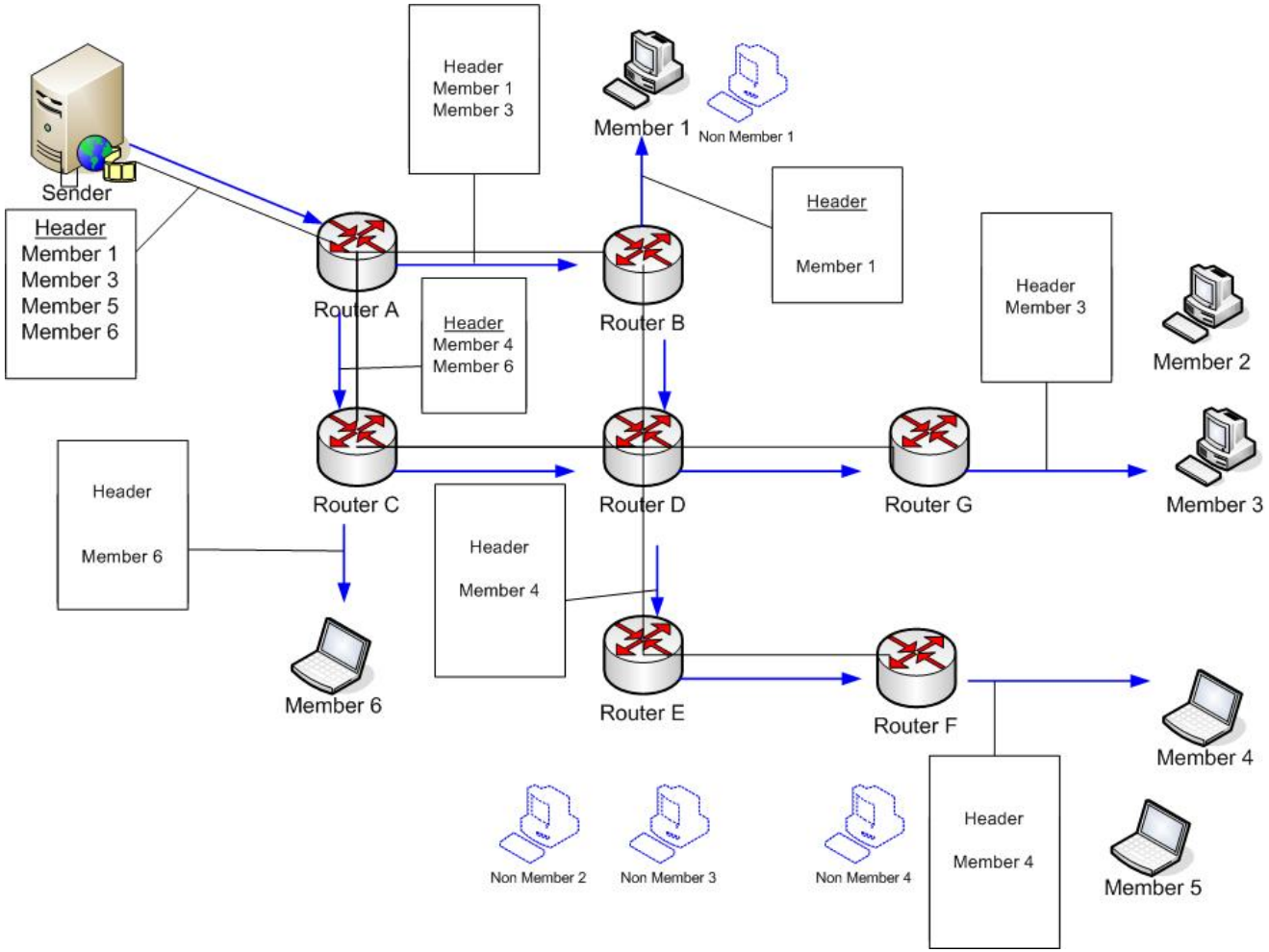
Multicast Routing Protocols

- Distance Vector Multicast Routing Protocol (DVMRP) [2]
- Multicast OSPF (MOSPF) [4,5]
- Protocol Independent Multicast (PIM)

Explicit Multicast Routing

- Xcast is a datagram delivery protocol for efficient small group communication
- Datagram transmitted with “explicit list of unicast addresses of receivers” [9]
- Intermediate routers forward and branch if needed, refering unicast routing tables all routers naturally maintain

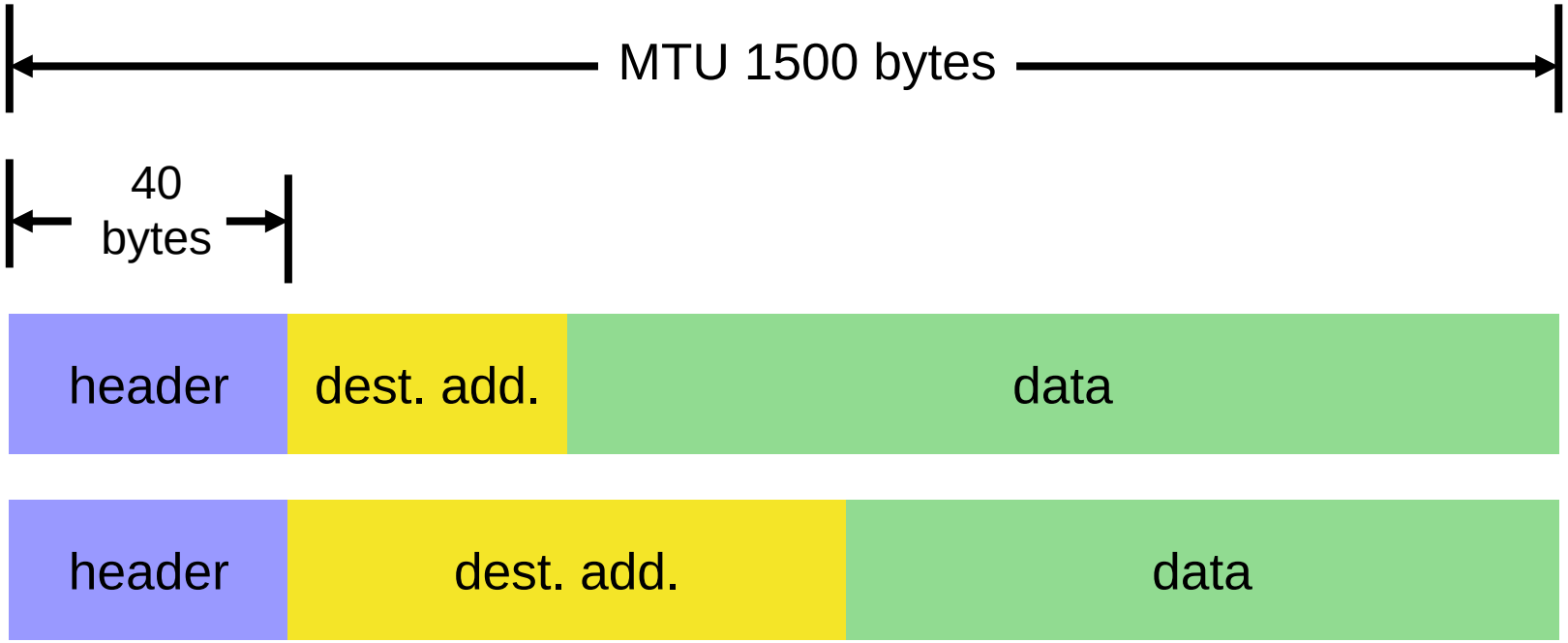
Explicit Multicast Routing



Explicit Multicast Routing

- Xcast stores explicitly addresses of all destinations in packet header
- Advantages of Xcast
- Disadvantages of Xcast
- Solutions

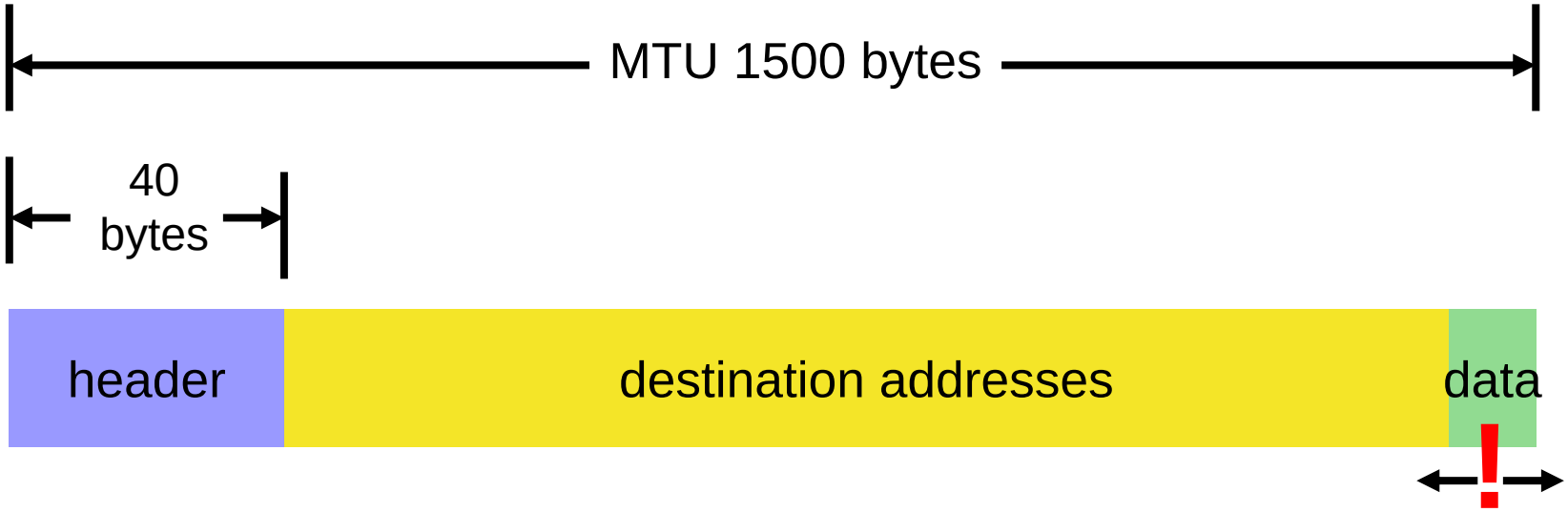
Xcast Packet



Advantages of Xcast

- Very effective in small groups
- No need of multicast addresses
- No need for multicast routing protocol
- The source encodes the list of destinations in the Xcast header, which gives a sense of security
- The Xcast packet can be converted into a normal unicast packet : called X2U (Xcast to Unicast)

Disadvantages of Xcast



Disadvantages of Xcast

- Less data/many packets
- Complex header processing at each router
- Xcast capable routers required
- Group membership is required at source
- QoS issue, Xcast uses shortest paths only.

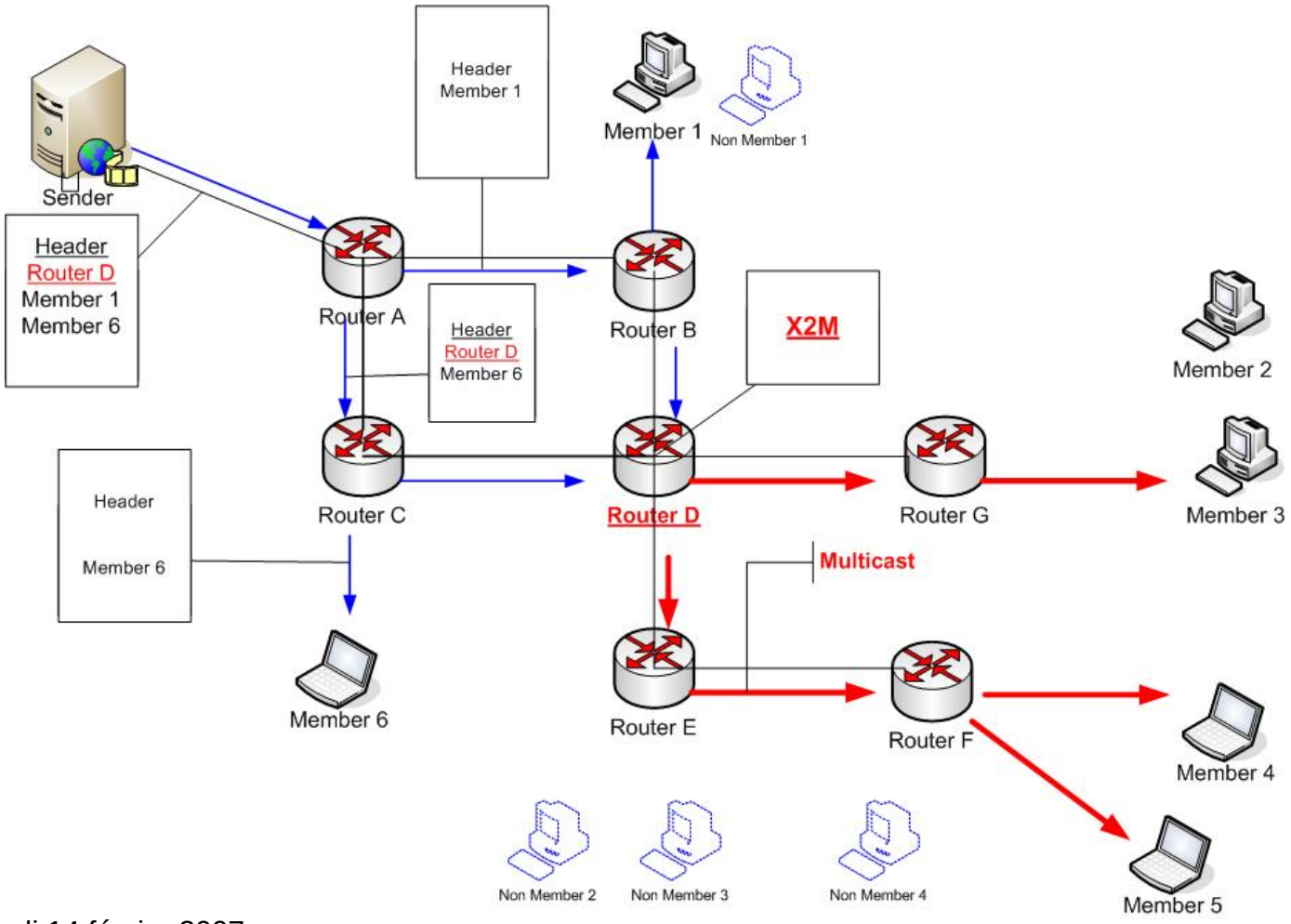
Solutions

- Packet fragmentation
- Fix the number of destinations, and send multiple packets
- Explicit Multicast Extension (Xcast+)
- Generalized Explict Multicast (GXcast)

Explicit Multicast Extension (Xcast+)

- Every host (source and destination) is assigned to a designated router
- Instead of client address, DR addresses are encoded in packet
- The DRs receives Xcast stream, Multicasts it (X2M) to destinations

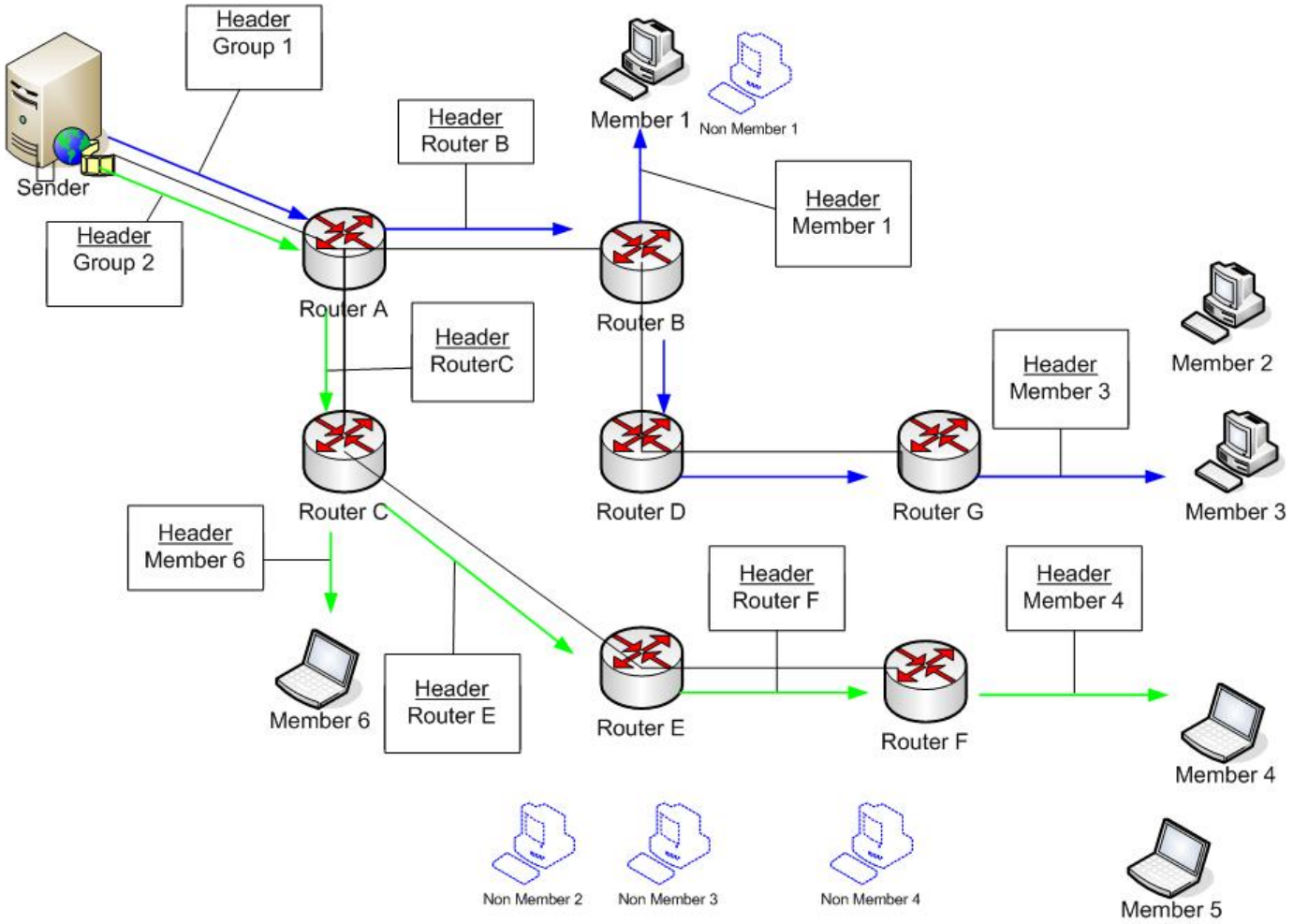
Explicit Multicast Extension (Xcast+)



Generalized Explicit Multicast (GXcast)

- Simultaneous streaming of many identical packets for different groups
- The list of destinations is cut into sub-lists
- Each sub-list corresponds to a destination list for Xcast packets
- Xcast & GXcast can interoperate easily
- Actual Payload doesn’t get effected

Generalized Explicit Multicast (GXcast)



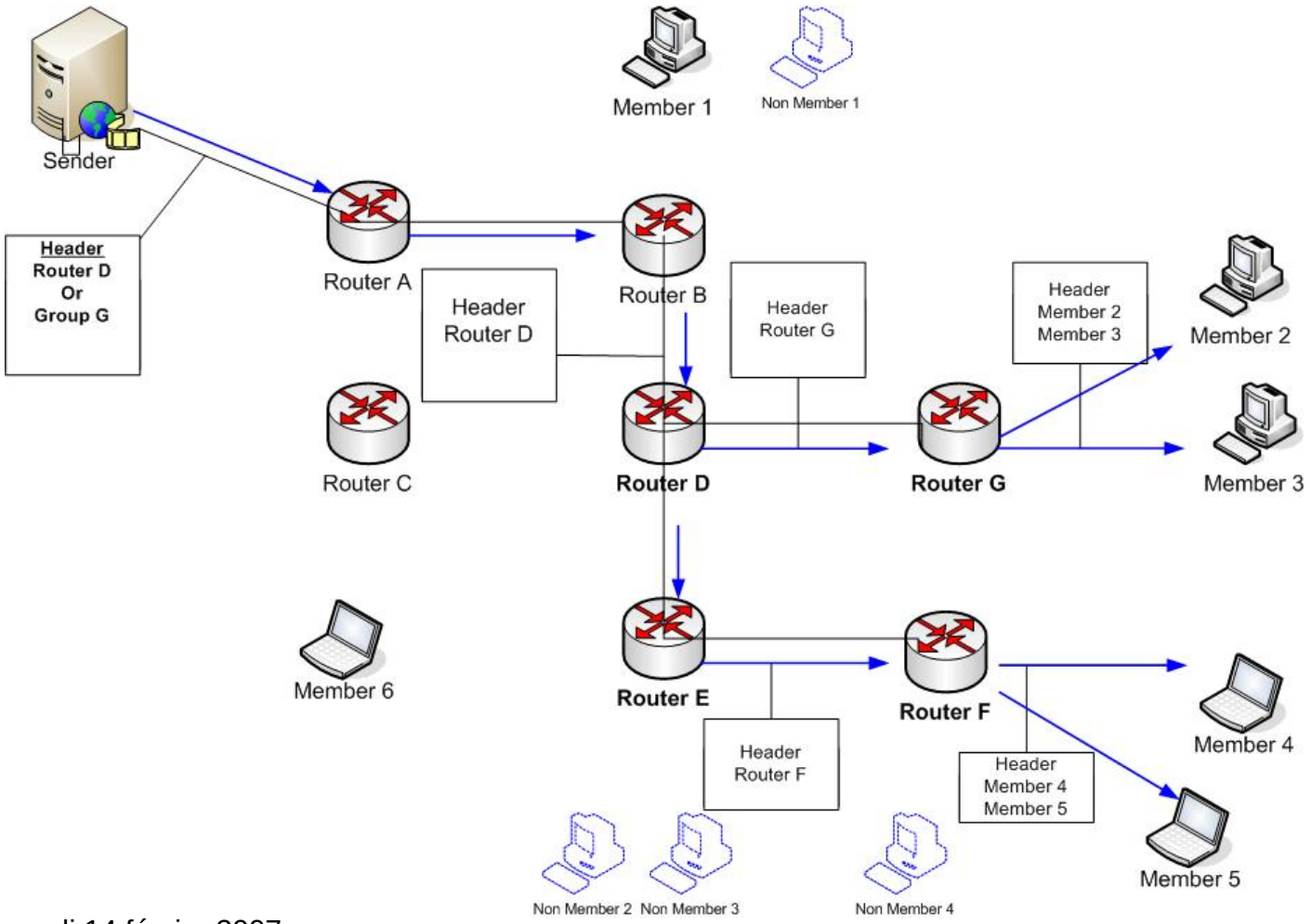
Problems of GXcast

- Latency due to extra header processing
- Packets are generated separately for each destination group, so those who are produced at the end, experience a larger delay
- Sorting of packets at source can reduce transmission time

Tree Based Explicit Multicast

- Sender doesn’t transmit packets with destination addresses
- Sender send packets with headers containing addresses of routers that act as branching nodes
- Intermediate routers have index of potential members of its branch
- Method is useful when lots of hops are unutilized in way of packet

Tree Based Explicit Multicast



Conclusion

- Numerous types of group communication
- Multicast still proves itself as only choice for communication in very large groups
- Further research is needed to replace traditional Multicast with Explicit Multicast or its extension to overcome constraints of Multicast
- Future research study will be based on Tree Based Explicit Multicast

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